THE GENITALIA OF THE GENUS *PHASIS* AND ALLIED GENERA. (LEPID. LYCAENIDAE)

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(With 2 plates)

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INTRODUCTION

Aurivillius (in Seitz) divides the *Phasis* group into two sections or three groups of species and sub-ordinate genera. There are approximately 46 species and subspecies. Below is given the classification as given in Seitz.

1. HW., two small tails, one at end of 1b and another at end of 2. FW 12 veins, vein 7 terminating into margin. *Phasis* Hubner.
2. HW., at end of 1, 1b angular or tailed, but always without tail at end of 2.
   (*a*) FW., above without black discal band or separate black discal spots—always 12 veins, vein 7 terminating into margin. Palpi below coarsely scaled, without bristly hairs. *Aloeides* Hubner.
   (*b*) (i) F.W., and often also HW above with black discal spots on light (orange) ground, or F.W above with coherent black discal band being only united with black marginal band in area 1b and at costal margin. *Poecilmitis* Butler.
   (ii) FW., 11 veins *Chrysoritis* Butler.
   N.B.—*P. zeuxo* and *chrysantas* also have only 11 veins.

Although the above can be taken as the classification now recognized, the genitalia have not so far been studied.

The principle laid down by Stempffer that 'today all authors should publish descriptions and figures of the genital armature of the species they study', is certainly necessary with the Lycaenidae and more especially with the *Phasis* group, because in most cases the valves are alike. All the species available have been so studied and lead one to a somewhat different division of the group. Besides the venation and other points noted in the above extract, the valves are found to be very similar in most cases; the anellus and juxta though distinct in some are not alone sufficient to separate the subordinate genera or the species.

A close study of the genitalia however shows that there is a natural division into two sections when the 'falces' (the two hooks of the gnathos) are compared. Some are 'straight', others are 'elbowed', dividing the whole group into about equal numbers. This difference is therefore used here to separate the numerous species into two sections. There can be little doubt that those included in each section show close affinity to each other. Apart from wing-colouring and size there seems to be no other character to distinguish them; the form of the aedoeagus is also helpful in distinguishing the species.

There are often many varieties among the species themselves, so that it is very difficult to separate them, especially with *pierus*, *thyra*, *taikosama* and others. Some have been named as *osbecki* from *thysbe*, but the former is now known to be distinct from the other. These differences in wing-colouring are not constant. Take for example the three species *pierus*, *thyra* and *taikosama*, they can seldom be separated for certain by wing-colouring and sometimes appear at different times or together. Riley (1938) says in the case of *thyra* that 'examination of the genitalia in seven widely different males (Cape Town) provided no character whatever on which to separate the various varieties, all seem exactly alike'. In another example he says 'a cursory (dry) examination of the genitalia confirms this finding'. But such an examination is hardly sufficient with such critical material, the very minutest comparison has to be made. That used by Stempffer, in all his papers, seems to be by far the best. By this, or what is called the 'open' method, the uncus holding the falces is separated from the tegumen, the valves and aedoeagus are also separated, so that each part can be studied separately and compared with the same in other species.

Polymorphism, E. B. Ford (*Butterflies* (*New Nature Series*)) says, 'is the occurrence together, in the same habitat of two or more distinct forms of a species, in such proportions that the rarest of them cannot be maintained by recurrent mutation'. This may help us to understand something about varieties in a species.

The genus *Phasis* is almost exclusively confined to southern Africa, only a few species being found farther north. They are generally small and brilliant coloured butterflies and in the sunshine shine like jewels.

Perhaps it will be best first to enumerate the species into the present recognized groups and then give short descriptions of each from a genitalic point of view.

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Messrs. C. G. C. Dickson, K. M. Pennington, Gowan C. Clark, D. A. Swanepoel and especially Dr. G. van Son of the Transvaal Museum, Pretoria, who very kindly went to some trouble (with a former paper on the same subject) pointing out the slips and errors as well as the difficulties to be faced by anyone who would venture to tackle this difficult group of South African insects.

That was some years ago when two papers were appearing on the genitalia of other groups of South African Lycaenidae (Murray, 1944, 1948). Since then a great deal of new material has come forward and the *Phasis* group has not been undertaken by anyone. It is to be hoped that this contribution, though by no means complete, or without errors, will help to bring the study nearer completion. There is a lot more still to be learnt, especially from the study of the early stages, from which alone we can be certain of distinction with critical species. Mr. C. G. Dickson and Mr. Gowan Clark have given us some valuable papers on this section.

At the end of this paper is given a list of food-plants, compiled for the most part from papers noticed in the references. This information is very valuable both to collectors and to breeders from whom (especially the latter) further knowledge is still to be gained from the study of these beautiful insects.

Genera and Species dealt with

Gen. *Phasis*

- *thero* (genotype)
- *clavum* (subspecies)
- *sardonyx*
- *argyraspis*
- *wallengrenii*
- *malagrida*
- *dicksoni*

Gen. *Aloeides*

- *pierus* (genotype)
- *egerides*
- *aranda*
- *simplex*
- *damarensis*
- *molomo*
- *almeida*
- *thyra*
- *pallida*
- *dentatis*
- *thyra maseruna* (subspecies)
- *taikosama*
- *orthus*
- *barklyi*

Gen. *Poecilmitis*

- *lycegenes* (genotype)
- *lyncurium*
- *tsino* (subspecies nov.)
- *chrysantas*
- *aethon*
- *lycia*
- *chrysaor*
- *phosphor*
- *pyroeis*
- *felthami*
- *zeuxo zeuxo*
- *zeuxo zonarius*
- *penningtoni*
- *turneri*
- *aridus*
- *palmus*
- *thysbe*
- *osbecki*
- *nigricans*
- *trimeni* (subspecies)
- *brooksi*
- *pelion*
- *pyramus*
- *Chrysorites oreas*
- *Crudaria leroma*

Several other species are awaiting description, including *Poecilmitis tsino*. Among the above *Aloeides pallida* was not available for dissection and among the *Poecilmitis*, *turneri* and *brooksi*, including also the subspecies.

The Two Sections based on the Genitalia

Falces 'straight'	Falces 'elbowed'
Phasis thero and the five other species named under *Phasis*. *Aloeides pierus* and all named under this genus, with the exception of *orthus* which has the falces 'elbowed'.	*Poecilmitis lycegenes* and all other species named under this genus, as well as *A. orthus*, excluding in both columns species not available for examination and the subspecies named.

Taken all together the total amounts to 46 species including the subspecies. It should be noted that *orthus* is distinctly misplaced among the *pierus-thyra* group, as it has the falces 'elbowed', i.e. from the genitalic view.

The figures of the genitalia have been made by the 'open' method and more or less uniform in size for ready comparison and with the aid of the camera lucida, to ensure accuracy.

There follow short descriptions of the genitalia. The data of all the species examined are given below.

Section I (Falces 'Straight')

I. *Phasis*, Butler (1869) U = uncus; V = valve; A = aedoeagus.

1. *P. thero* L. Type. (Pl. III, 1.) The genitalia of this and the next three species approximate to *Capys alphaeus* Cram. U. broad, well developed. V. large bottle-shaped, apex a straight serrated edge. Anellus large. A. broad, saccus produced into a hooked point. Cape Flats. 9/30.

P. clavum, Murr. (subspecies). The genitalia are almost the same as *thero* but the wing expanse smaller; forewing more rounded and the marking differing considerably; it has one tail only, not two as in *thero*. Taken at Nieuwoudtville, Vanrhynsdorp Dist., Cape, by Dr. G. van Son, 8/27. Since then it has been found at several places around Boskloof near De Wet in the Worcester Dist. by Mr. D. A. Swanepoel and others, all over the Karoo.

2. *P. sardonyx* Tr. (Pl. III, 2.) V. shaped somewhat like a boomerang, inner edge produced into a fine blunt point. Anellus large, divides into two long arms. A. broad with pointed apex holding cornuti; saccus produced. Cape Prov. 1941 (Gowan C. Clark).

3. *P. argyraspis* Tr. (Pl. III, 3.) Genitalia similar to the last except that the apex of the valve is convex instead of concave ending in a blunt knob instead

of a point; anellus two large pointed processes. Graaff-Reinet, Cape. 3/40 (Swanepoel).

4. *P. wallengrenii* Tr. (Pl. III, 4.) U. broad with rounded pads. V. pointed. A. very large and broad, divided at apex. Anellus small, shaped like a triangle. Mamre Dist., Cape. 3/37 (Dickson).

5. *P. malagrida* Walleng. (Pl. III, 5). U. broad. V. very similar in shape to *pierus* but smaller Anellus large triangular-shaped. A. large and broad. Lion's Head 2/35 (Dickson).

6. *P. dicksoni* Gabr. (Pl. III, 6.) U. broad. V. large and broad. Anellus small, triangular-shaped. A. large, ending in a fine point. The male of this species was first found by Mr. C. G. Dickson near Melkbosstrand in 9/46; the female the following year 8/47.

II. *Aloeides* Hubner (1816).

7. *A. egerides* Riley. (Pl. III, 7.) U. narrow. V. narrow and pointed with a distinct indentation about middle. Anellus small. A. long, the apex bulbous. Philadelphia, Cape. 3/36 (Dickson).

7a. *A. pierus* Cram. (Pl. III, 7a.) U. a narrow, hairy pad. V. large, restricted at apex, broad about middle, rounded off at base. Anellus a large broad triangular process. A. large, tapering to a blunt point. Wynberg, Cape. 11/36. Stellenbosch, Cape. 10/36.

8. *A. aranda* Walleng. (Pl. III, 8.) U. narrow. V. same as *malagrida.* Anellus a small triangle. A. large, broad. Natal, 1941.

9. *A. simplex* Tr. (Pl. III, 9.) U. narrow. V. large, ending in a blunt point. Anellus large, apex two short points. A. large with broad apex. Tsaborg, Bechuanaland. 12/55 (Pennington).

10. *A. damarensis* Tr. (Pl. III, 10). Genitalia similar to *molomo.* A. broad with blunt apex. Anellus smaller. Zululand and Natal coast Dist.

11. *A. molomo* Tr. (Pl. III, 11.) U. broad. V. broad, bottle-shaped. A. tapering to a point at apex. Anellus a large process, apex and base pointed. Johannesburg, Transvaal. 10/02 (Feltham Coll., Johannesburg University).

12. *A. almeida* Feld. (Pl. III, 12.) U. narrow. V. long and narrow, ending in a blunt point. Anellus a large triangular process. A. large and broad with a blunt apex. Weenen, Natal. 11/31.

13. *A. thyra* L. (Pl. III, 13.) U. narrow. V. bottle-shaped like *pierus*, but smaller apex a blunt point. Anellus a large triangular process. A. large and broad, apex blunt. Cape and Colenso, Natal. 1928.

14. *A. taikosama* Walleng. (Pl. III, 14.) U. narrow. V. and A. very similar to those of *thyra.* Anellus smaller. Brakpan, Transvaal. 10/30; Springs, Transvaal. 2/37.

15. *A. barklyi* Tr. (Pl. III, 15.) U. narrow. V. differs considerably from the other species, a long narrow arm with a rounded apex, there is also a broad point attachment about the middle. Anellus has apex produced into two fine points. A. moderate in size, broad with several cornuti at apex. Namaqualand, Aughrabies. 9/49 (Swanepoel).

Species not available for dissection, *pallida*.

SECTION II (FALCES 'ELBOWED')

III. *Poecilmitis* Butler (1899).

1. *P. lycegenes* Tr. (genotype). (Pl. III, 16.) U. broad with two prominent hairy pads. V. broad at centre and base narrowing to a blunt point at apex. Anellus small, triangular-shaped at top but broadening at base. A. long, broad, ending in a fine point. Natal, 1941 (G. Clark).

2. *P. lyncurium* Tr. (Pl. III, 17.) Very similar to last species but V. smaller and not so broad. A. more narrow. Mbulu, Transkei, Cape. 1/33 (Pennington).

It is unnecessary to describe all the species given under this section as they are very similar to each other, though differing slightly, as will be seen from the drawings.

3. *P. chrysantas* Tr. (Pl. III, 18.) Naauwpoort, Cape, 12/31 (Gowan C. Clark).

4. *P. aethon* Tr. (Pl. III, 19.) Pilgrim's Rest, N. Transvaal. 12/45 (Swanepoel).

5. *P. lycia* Riley. (Pl. III, 20.) Matjesfontein, Cape. 3/52 (Swanepoel).

6. *P. chrysaor* Tr. (Pl. III, 21.) Riebeek Kasteel Mts., Cape. 4/37 (Dickson).

7. *P. phosphor* Tr. (Pl. IV, 22.) Newstead, Balgowan, Natal. 5/34 (Pennington).

8. *P. pyroeis* Tr. (Pl. IV, 23.) Cape. 11/36 (Dickson).

9. *P. felthami* Tr. (Pl. IV, 24.) Cape Flats, Cape. 11/37.

10. *P. zeuxo zeuxo* L. (Pl. IV, 25.) Cape Pen. 2/27; Oakford, Natal. 2/38.

11. *P. penningtoni* Riley. (Pl. IV, 26.) Gaikaskop, Cape. 1/35 (Pennington).

12. *P. aridus* Penn. (Pl. IV, 27.) Springbok, Cape. 10/55 (Pennington).

13. *P. palmus* Cram. (Pl. IV, 28.) Tygerberg Hills, Cape. 11/45 (Dickson).

14. *P. thysbe* L. (Pl. IV, 29.) Cape Dist. 4/36 (Dickson).

15. *Aloeides orthus* Tr. (Pl. IV, 30.) Mountain Drive, Second Pass, Basutoland. 1/57 (Pennington).

16. *P. pyramus* Penn. (Pl. IV, 31.) Zwartberg Pass, Cape. 11/46 (Pennington).

17. *P. tsino.* (Pl. IV, 32.) Mbulu Ridge, Cape. 11/54 (Swanepoel). Not yet described but very near to *P. lyncurium.*

P. turneri was not available for examination.

IV. *Chrysoritis* Butler (1898).

18. *C. oreas* Tr. (Pl. IV, 33.) This species was rediscovered by Mr. M. Pennington after a lapse of some 70 years or more. Niginya, Natal. 12/27 (Pennington).

V. *Crudaria* Wallengren. Recognized as a distinct genus by Aurivillius.

19. *C. leroma* Walleng. (Pl. IV, 34.) The genitalia of this species differ from those of all the *Phasis* and so it has been placed in a genus of its own. De Wildt, Pretoria, Transvaal. 12/32.

VI. *Anthene* Doubleday (1847).

This genus is included here in order to complete the study of all the South African Lycaenids; the other groups have been dealt with previously (Murray, 1944, 1948, 1956).

The genus was created by Doubleday in 1847, afterward placed under *Lycaenesthes* Moore in 1865, the genotype being *A. larydas* Cram. It is a very large genus but there are only a few representatives in South Africa. Among other characters it is distinguished by the two or three slender pencils of hair which nearly always occur on the hind-wings at the extremities of veins 1, 2 and 3. The genitalia are very distinct, the aedoeagus always long and well developed. Bethune-Baker revised the whole African genus in 1910, including most of our species, though the figures he gives of the genitalia, from photographs, are not very helpful in distinguishing the various species. Very few life histories, including the food-plants are so far known. The descriptions given below are very brief.

1. *Anthene larydas* Cram. (genotype). (Pl. IV, 35.) U. rounded into two large hairy pads. V. of moderate size, bottle-shaped, apex blunt. A. very long and broad. Anellus large, forming a three-pronged process; saccus produced. Durban, Natal. 6/31.

2. *A. amarah* Guer. (Pl. IV, 36.) U. pads small. V. oblong in shape, inner apex pointed, outer rounded. A. very long, blunt at orifice. Anellus a crossed process, resembling a wide X. Brakpan, Transvaal. 5/51; Naboomspruit, N. Transvaal. 4/32.

3. *A. livida* Butl. (Pl. IV, 37.) V. of moderate size, broad, divided at apex into two pointed teeth. A. long, blunt at orifice. Anellus small. Pretoria, Transvaal. 9/45.

4. *A. definita* Butl. (Pl. IV, 38.) V. very large and broad, divided at apex into fine pointed teeth. A. long and narrow. Anellus small; saccus produced. Warmbaths, Transvaal. 4/32; Pretoria, Transvaal. 10/37.

5. *A. otacilia* Tr. (Pl. IV, 39.) V. round at base with a very long bent arm, ending in a fine point, holding a blunt knob near middle with two fine spines. A. long and narrow. Anellus small. Natal, 1941.

6. *A. princeps* Butl. (*neglecta* Tr.) (Pl. IV, 40.) V. very large and broad, almost as large as the whole organ, apex divided into a series of strong teeth; about middle a long, pointed arm, also with teeth. A. long and narrow, bulbous at apex. Anellus very small; saccus produced. Howick, Natal. 3/34 (Pennington).

7. *A. lemnos* Hewit. (Pl. IV, 41.) V. very large, almost round in shape, apex minutely divided. A. very long, broad, ending in a blunt point. Saccus ending in a long fine point. Anellus two curved arms. Durban, Natal. 12/34.

8. *A. millari* Tr. (Pl. IV, 42.) V. of moderate size, heart-shaped, upper edge serrate. A. very long and narrow. Anellus small. Weenen, Natal (Tring Museum).

9. *A. minima* Tr. (Pl. IV, 43.) V. divided at middle, where the inner edge is produced to a fine sharp point; upper half of V. a long, curved serrate arm. A. very long, ending in a fine point. Anellus pear-shaped, divided into two points. Saccus produced to a point. Northdene, Natal. 1/33 (H. Millar).

10. *A. talboti* Stempff. (1936). (Pl. IV, 44, redrawn from Stempffer's figure.) This species was found some years ago at Chuckomaas, Natal, by Mr. L. S. Higgins; it also occurs in Kenya. The genitalia are similar to *definita* but the V. is divided into distinct long, pointed spears. Anellus very large and broad.

11. *A. contrata* taken by Pennington in 4/53. Natal?

VII. *Desmolycaena* Trimen. (1898).

Desmolycaena Mazoensis Tr. (Pl. IV, 45.) Uncus broad. Falces small. Valve oblong in shape. Aedoeagus broad of moderate size, blunt at apex. N. Transvaal, 1947 (Swanepoel).

One or two other species have been found in recent years but they are not available.

SUMMARY

The genitalia of the genus *Phasis* (Lepid. Lycaenidae) and its subordinate genera have been worked out, accompanied by figures of all the species available, as these have not so far been given by any other worker. The paper suggests a natural division of the approximate number of 46 species into two sections of equal numbers by means of the different shaped 'falces' or hooks of the gnathos. There is added the small number of South African species of the genus *Anthene* to complete the whole study of the South African Lycaenidae; others being dealt with elsewhere. At the end a list of food-plants and necessary references are added.

FOOD-PLANTS

Phasis—

1. *zeuxo zeuxo*	Chrysanthemoides moniliferum C. incana	Compositae	Cape (Dickson, 1953). Eggs generally laid singly on fresh or withered leaves, also on stem and bark.
2. *lycia*	Royena hirsuta and other plants	Ebenaceae	Cape (Swanepoel, 1953).
3. *chrysaor*	Zygophyllum sessilifolium and Rhus sp.	Zygophyllaceae	Cape (Dickson, 1943). Eggs laid singly on underside of leaf.
4. *felthami*	Z. sessilifolium Z. flexuosum	Zygophyllaceae	Cape (Dickson, 1940).
5. *malagrida*	Aspalathus sp.	Leguminosae	Cape (Dickson, 1940).
	Ifloga laricifolia	Compositae	Cape (Dickson, 1940). Eggs generally laid singly, sometimes in pairs on stem.
6. *wallengrenii*	Senecio pubigerus	Compositae	Cape (Dickson, 1953).
7. *dicksoni*	Danthonia stricta	Gramineae	Cape (Dickson, 1953).
	Leucadendron sp.	Proteaceae	(Cape (Dickson, 1953).
	Pelargonium flavum	Geraniaceae	Cape (Dickson, 1953).
8. *taikosama*	Felicia muricata	Compositae	Transvaal (Murray, 1937). Reared on by G. C. Clark.
	Aspalathus sp.	Leguminosae	
9. *turneri*	Zygophyllum sp.	Zygophyllaceae	Western Karoo (Dickson, 1953).
10. *thysbe*	Aspalathus sp.	Leguminosae	Cape (Dickson). Reared on this plant.
	Chrysanthemoides	Compositae	Eggs laid singly on leaf and stem. (Dickson).
11. *nigricans*	Senecio sp.	Compositae	Cape (Dickson, 1947).
12. *palmus*	Aspalathus sarcantha	Leguminosae	Cape (Dickson, 1953).
	Berzelia sp.	Bruniaceae	
13. *thero*	Melianthus major Rhus sp.	Melianthaceae	Cape (Murray, 1939).

The following species have been reared on Aspalathus sp. by Mr. G. C. Clark: *pierus*, *aranda thyra*, *almeida* and *damarensis*, and *Crudaria leroma* on Acacia Karroo.

Anthene—

1. *definita*	Albizzia lophanta Acacia, Rhus and other plants	Leguminosae	Cape (Penfold). Natal (Clark) on flower buds and fruit.
2. *lemnos*	Micrococca berberidea	Euphorbiaceae	Natal (Dickson, 1954).
3. *minima*	See Refer. (Clark, 1940)		Natal (Clark, 1940).
4. *livida*	Kalanchoe crenata	Crassulaceae	Kenya (Jackson, 1937).
Desmolycaena mazoensis	Acacia sp.	Leguminosae	Zululand (Pennington, 1953 and 1956).

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